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Review

Splenic injury in colonoscopy: A review

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ABSTRACT

Introduction: Splenic rupture secondary to colonoscopy was first reported in 1974 by Wherry and Zehner. It has an incidence of around 0.00005–0.017%, and a mortality rate of 5%.
Method: We performed a literature search to identify the demographic profile, risk factors, clinical presentations, diagnosis and management of this rare complication.
Results: There were 66 patients (51 females and 14 males), with a median age of 65. The mortality rate was 4.5%. Majority ($n = 41$, 62.1%) occurred in uneventful colonoscopies. Symptoms usually (74%) occurred within 24 h, and 55.8% presented within 24 h. Majority (93.9%) had some form of work-up done, with blood tests (78.8%) and CT (68.2%) being the most frequent. Laparotomy and splenectomy were done in over half (56.1%) of the patients. Splenic hematoma (47%), laceration (47%) and rupture (33.3%) were the most common findings.
Conclusion: Splenic injury is an important complication to be aware of as its number will continue to rise with the increasing numbers of colonoscopies being performed for colorectal diseases, and delayed diagnosis may result in adverse outcome for the patient.

1. Introduction

Colonoscopy is a common and safe procedure. It is increasingly being used for diagnostic and therapeutic purposes. Complications commonly reported are intraluminal bleeding (0.3–2.1%) and perforation (0.1–2.5%).[1–36] These are often associated with biopsy or polypectomy.[2,4,12,13,16,18,26–29,32,35] Rare complications reported include mesenteric tear, portal vein gas, pneumomediastinum, pneumothorax, retroperitoneal emphysema, pneumoscrotum, retroperitoneal abscess, septicaemia, incarceration of hernia, diverticulitis, appendicitis, volvulus, and methane or hydrogen gas explosion.[1,3–6,8,9,11,12,14–19,21,27–30,32–35]

Splenic rupture was first reported in 1974 by Wherry and Zehner.[1–4,6,7,9,12,14,16,17,19,28,30,34,37,38] Its incidence has been reported to be around 0.00005–0.017%, with a mortality rate of 5%.[4,5,7,12,13,18,19,21,24,34,36,39] The diagnosis is often delayed as it is a rare occurrence and early symptoms are often attributed to air insufflations and the resultant colonic distension and post-polypectomy serositis, and is also often masked by analgesia, sedation, old age or impaired mental status.[3–5,16,22,28,30] It may be under-reported due to reluctance to publish morbidity information, publication bias, absence of specific code for this complication and the fact that the majority of these cases may remain undetected.[1,4,11,24,29,40] Its number will continue to rise with the increasing numbers of colonoscopies being performed for colorectal diseases.

2. Method

We performed a Medline, Embase and Pubmed search based on the key words "splenic injury" and "colonoscopy". The data recorded were patient characteristics (gender, age, previous abdominal surgery), colonoscopy characteristic (ease of procedure, manoeuvres and biopsy/polypectomy), clinical presentation (time to symptom, presentation and definitive management, abdominal pain, distention, guarding, back pain, chest pain, Kher's sign, hemodynamic status, nausea and vomiting), investigations (blood tests, x-ray (XR), barium swallow/enema, ultrasound scan (USS), paracentesis, angiogram, computed tomography scan (CT)), management (type, blood found) and findings (adhesions, cysts,

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hematoma, laceration, and rupture). These were analysed with the Statistical Package for Social Sciences program.

3. Results

3.1. Demographic profile

Sixty-six patients were identified from the literature search. One patient included was from our own recent experience. There were 51 females (77.3%) and 14 males (21.2%). One article did not specify the gender of the patient. There was no obvious explanation for this. Age had not been reported to be a risk factor, and the median in our report was 65 (range 29–90), which was consistent to the previously reported age of 64.[4,6] Previous abdominal surgery ($n = 25$, 47% vs no previous history n = 31, 37.9%) was not associated with a higher risk of injury.

3.2. Outcome

There were 3 reports (4.5%) of death from splenic injury in the literature. These were all associated with splenic laceration and no previous abdominal surgery.

3.3. Colonoscopy

The ease of colonoscopy was not associated with a higher rate of splenic injury, where 41 (62.1%) were reported to be uneventful and there were 3 deaths in this group. Five were reported to be moderately difficult and 10 were difficult.

Only 8 (12.1%) reported manoeuvres to assist the procedure. Of the available data, only 19 (28.8%) had biopsy/polypectomy performed (range 1–5).

3.4. Presentation

Seventy-four percent developed symptoms within 24 h and 81% within 48 h (range 30 min to 7 days). However, only half of these patients (55.8%) presented within 24 h and 64.8% within 48 h (range immediate to 100 days).

Over a third (36.4%) of the patients described left upper quadrant pain, 30.3% had generalised pain, and 5 did not describe abdominal pain. Eight patients each (12.1%) described back pain and chest pain. Majority of the patients ($n = 54$, 81.8%) did not have nausea and vomiting, abdominal distension ($n = 43$, 65.2%), or guarding ($n = 46$, 69.7%).

There were equal numbers ($n = 28$, 42.4%) of patients who did and did not report Kehr's sign (gentle bimanual palpation of the left upper quadrant with the patient in a light Trendelenburg position results in diaphragmatic irritation reflected as pain at the tip of the left shoulder).

Hemodynamic instability was described in less than half ($n = 29$, 43.1% vs $n = 8$, 42.4%). Of the available data, the median amount of blood found was 2 L (range 300 mL–3 L). Only 12 (18.2%) described adhesions intra-operatively. More than half ($n = 37$, 56.1%) described splenic hematoma, 31 (47%) laceration, and 22 (33.3%) rupture. Only one article described avulsion of the spleno-colic ligament.

3.5. Diagnosis

Majority (93.9%) had some form of work-up done as shown in Table 1.

Delay in diagnosis was common. Colonoscopic visualization of free blood in the peritoneal cavity through the colon wall had been reported to aid in the diagnosis.[41]

Table 1
Type of investigations for splenic injury.

Type of investigation	Yes	No
Blood	52 (78.8%)	4 (6.1%)
XR	22 (33.3%)	34 (51.5%)
Barium tests	2 (3%)	62 (93.9%)
USS	10 (15.2%)	48 (72.7%)
Paracentesis	1 (1.5%)	63 (95.5%)
Angiogram	2 (3%)	54 (81.8%)
CT	45 (68.2%)	15 (22.7%)

3.6. Management

The majority (45.4%) of the definitive management was decided within 24 h, and 59% within 48 h (median = 24 h, range immediate 112 days). Conservative management was attempted in 25.8% ($n = 17$). The managements reported in the literature are illustrated in Table 2.

4. Discussion

Many of the splenic injuries occurred in apparently uncomplicated, easy colonoscopies performed by experienced endoscopists, and often there are no risk factors, biopsy, or polypectomy in those cases.[1,2,16,17,19,20,22,40,42] This has been illustrated in this review. It seemed that the complication rate was related to neither the level of experience nor the number of colonoscopies performed.[19,20]

There are several explanations for splenic trauma during colonoscopy and the mechanism is yet to be elucidated. We could not identify any risk factors from our review, apart from the higher risks in female patients. This was consistent with other reports in the literature, where 72–75% of the cases occurred in females.[4,5,42]

The factors associated with splenic trauma identified by other authors are presented in Table 3. Difficult intubations result in direct injury during manipulation through the splenic flexure secondary to the transcolic pressure or looping of the instrument, which has been thought to be a factor.[5,6,9–11,14,16,21,23,24,28,37,38,42–44] In addition, the traction due to the spleno-colic ligaments, adhesions between the colon and spleen, or the presence of a large polyp or mass at the splenic flexure, and the passage of colonoscope may result in splenic capsular avulsion and laceration, which is more likely than rupture.[1,3–7,9–12,15,16,18,20–25,28,30,33,34,37–39,42,43,45–49] Excess traction on the ligaments from external pressure on the left hypocondrium to straighten the scope during colonoscopy may simulate a blunt abdominal trauma with sufficient force to result in splenic injury.[3–5,16,17,20,23,34,37] Entry into the ileum with ileal biopsy has been suggested to increase the torque of the scope at splenic flexure secondary to the increased working distance of the scope.[3] Sedation and drug-induced reduction of pain have also been implicated in the development of this complication.[7,18,20] There were reports showing that in carefully performed colonoscopy without anesthesia, only 2.4% of patients reported moderate pain.[18] This sedation-free method has been advocated to reduce cost, hasten recovery time, and force the endoscopist to be more cautious and gentler in the manipulation of the scope, which may help to reduce the chance of injury and post-procedure morbidity.[18]

Table 2
Reported management of splenic injury post-colonoscopy.

Management	Frequency
Conservative	18 (27.3%)
Laparotomy and splenectomy	37 (56.1%)
Embolization	3 (4.5%)

Table 3
Risk factors for splenic injury.[1,3–9,12–14,16–18,20,21,23,27–30,37,38,40,43,47,50]

Patient dependent
(1) Splenomegaly
(2) Adhesions between spleen and colon from prior surgery
(3) Neoplasm
(4) Inflammation: diverticular disease, pancreatitis, inflammatory bowel disease, endometriosis
(5) Infection: malaria, typhoid fever, Epstein–Barr virus-induced mononucleosis
(6) Anticoagulation
Operator dependent
(7) Supine position
(8) Inexperienced operator
(9) Biopsy, polypectomy
(10) Excess traction
(11) Direct injury
(12) Techniques: hooking splenic flexure to straighten left colon, external pressure on the left hypochondrium, slide by advancement, alpha manoeuvre, straightening sigmoid loop
(13) Technically difficult colonoscopy
(14) Multiple previous colonoscopies

Some authors believed that ancillary manoeuvres or position change, and polypectomies or biopsies are risk factors, as was indicated in our review.[41] However, some believed that positioning the patient in a left lateral position instead of the supine position allowed the spleen and the splenic flexure to fall to the left, preventing opposing splenic and colonic tension that occurred in the supine position and this may reduce the incidence of this undesirable complication.[1,4,17,18,20,44] Minimizing external pressure has also been suggested in high-risk patients to prevent this complication.[4]

Symptoms were usually reported in the first 24 h after colonoscopy and splenectomy was the sequel in most cases.[3,17,36] However, some were delayed, representing the delayed rupture phenomenon following blunt abdominal trauma.[50] Signs of peritonism might not be present initially, and might appear later in the course.[1] Kehr's sign was believed to be due to the irritation of left diaphragm or splenic capsule distention.[41] It was reported to occur in up to 90% of the patients but was also reportedly present in 50% of uncomplicated colonoscopies, thereby limiting its usefulness.[13,41] Our review showed that only half of the patients exhibited Kehr's sign.

For accurate diagnosis it should be considered in patients as a possible complication and a high index of suspicion.[2,4,5,16,39,40] Therefore, pain within 12 h of procedure warrants observation as splenic rupture is a rare but potentially fatal complication.[1,2,4,5,8,14,16,28,45] However, perforation and mucosal haemorrhage should be ruled out first before considering uncommon complications.[5,16]

Whilst asymptomatic rupture had been described,[16,19,42] the majority of splenic injuries were diagnosed or confirmed during laparotomy before 1987.[6,21] With the advent of sophisticated imaging techniques like CT and USS in 1989, these have been increasingly used to aid its diagnosis.[6,13] Some were still diagnosed during laparotomy.[2] The diagnosis was often made by CT, USS, laparotomy, or autopsy.[5,9,19,30,37] Diagnosis should be made clinically but CT scan provided the most sensitive and specific method for definitive diagnosis and also indicated the best management option, as it was highly accurate for the detection of splenic injury, and was able to delineate the extent of injury and hemoperitoneum, and differentiate between perisplenic clot and hemoperitoneum, which helped to determine the need for laparotomy.[1,4,7–9,11,14,16,17,19,21,28,36–38,42,43,45,48] The anatomic definition of injury provided an objective criterion for the classification of degrees of splenic injury.[1] The current helical and spiral scanning CT methods allow for a more precise delineation of organ fracture and intraparenchymal vascular disruption.[1] While grading scale has been used to predict the likelihood of successful non-operative management, it has also been reported to be unreliable in predicting the success of conservative management in splenic injury; therefore it should be interpreted carefully as reliability for high-grade splenic injuries is low and the magnitude of injury is often underestimated even by experienced radiologists.[1,10] The use of contrast can identify any active extravasation to aid conservative management.[12] It can also show other rare complications like hepatic injuries and mesenteric hematomas.[9,42,43]

The ability of CT to predict the success of conservative management is inconsistent.[41] It is important to evaluate the intra-abdominal and retroperitoneal structures and visualize the initial splenic injury, and in conservative management to follow its progression and resolution.[41] Whilst CT is able to guide the decision for management options, the hemodynamic status is the primary factor used to determine the therapeutic option.[16]

USS is a cheap and rapid method, but increasing amount of gas in the bowels after colonoscopy may limit its usefulness.[16,19,21,28,39] It can also rapidly identify the presence of free fluid in the abdomen in unstable patients.[19] Paracentesis is also another less expensive investigation but lacks sensitivity.[39] Whilst angiography may indicate splenic rupture, it can sometimes be inconclusive.[16]

While splenectomy was the definitive management, conservative management (in 25% of the reports) with bed rest, intravenous antibiotics, close hemodynamic monitoring, volume replacements, serial haemoglobin checks and imaging, or arterial embolization had been successfully reported.[4,7–9,16,17,20,37] Conservative management might require more blood transfusions than operative intervention so the risks associated with transfusion should to be considered.[10,16]

The argument for conservative management was that failure rates had been reported to be as low as 10% with careful interpretation of imaging, and there was a risk of developing overwhelming post-splenectomy infection (1% for adults), as long as the subcapsular hematoma was closed, splenic hilum was intact, and there was no hemoperitoneum (as this is a risk factor for shock), pre-existing splenic disease, hemodynamic stability, requirement for and efficacy of blood transfusion, and coagulopathy.[1,9,18,38,41,48] The predictors of failed conservative management were grade II traumatized spleen on CT, old age, pre-existing splenic disease, hemodynamic instability, one unit of blood transfusion and hemoperitoneum.[1,4,10] The general guideline for hemodynamic instability was systolic blood pressure below 90 mmHg or tachycardia over 120 beats/min when there was no immediate response to 1–2 L of crystalloid resuscitation and when examination and investigations indicate hemoperitoneum.[1]

Embolization had been reported to be safe and cost effective, and can potentially preserve splenic function.[18,20,37] Compared to the trauma literature, the splenectomy rate is higher.[6] The rate was 100% before 1988, but it has since decreased to 61.5%.[6] The embolic material can be absorbable or nonabsorbable depending on whether temporary or permanent occlusion is warranted, whether proximal or peripheral occlusion is desirable, depending on the individual vascular anatomy.[37]

5. Conclusion

It has been suggested that factors that indicate further evaluation of persistent abdominal pain after colonoscopy include hemodynamic instability, clinical features of acute abdomen, leukocytosis, positive Kehr's sign and/or acute anemia.[16,17,20,28,29,37,42,48] Therefore, onset of abdominal pain associated with one or more of these factors within 24 h warrants close monitoring and further investigation, bearing in mind that some splenic trauma do present later.[16,19,20,24,28,29,37,42,48] Our review indicated that abdominal pain within 24 h was the most reliable indication for splenic injury.

Preventative measures in difficult procedures including repositioning, desufflation, avoiding excessive force in manual manoeuvres, good scope manipulation to prevent loop formation, and

cautious use of sedation with attention to patients' response may have a place in the reduction of complication.[18,47] Written information and inclusion of this complication during the consent process may heighten awareness of this complication.[47]

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